REMARKS

By this Preliminary Amendment, the application has been amended to conform with U.S. practice, the cross-reference to related applications has been inserted on page 1, the specification has been amended to change claim dependencies, and claims 44-86 have been canceled and replaced with new claims 87-108. No new matter has been introduced. Entry of this amendment is respectfully requested.

Respectfully submitted,
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EXHIBIT A

A marked-up Version of Prior Pending
Paragraphs Showing the Changes Made

Page 1, for the first full paragraph, please substitute the following paragraph:

--The invention concerns to a procedure for the photometric determination of the quality of gas, particularly of burnable gases, according to the pre-characterising part of claim [44] 87 and claim [51] 94 and also devices for the photometric determination of the quality of gas, particularly of burnable gases, according to the pre-characterising part of claim 98 [55 and claim 66] .--

On Page 8, please replace the third full paragraph with the following paragraph:

--The solution of the object according to the invention results in respect of the procedures from the characterising features of the claims [44] 87 respectively [51] 94 in accordance with the features of the associated pre-characterising part. The solution of the object according to the invention results in respect of the devices from the characterising features of claim 98 [the claims 55 respectively 66] in accordance with the features of the associated pre-characterising part. Further advantageous embodiments of the invention result from the respective dependent claims.--

On Pages 8-9, please replace the last paragraph bridging pages 8 and 9 with the following paragraph:

--The invention concerns to a first procedure according to claim [44] 87, with which the determination of the quality of gas of a probe gas, in particular a burnable gas, is carried out based on a spectrum of the probe gas determined under operating conditions by means of infrared spectroscopical measurement procedures. Herein the quality of gas of a probe gas is determined in such a way according to the invention, that in a first step of the procedure the amounts of substances x_i of the components of the probe gas at operating conditions are determined out of the spectrum, where after default values for compressibility factor K and real gas factor Z_n are preset for calculation of the wanted compressibility factor K and than out of quantities at operating conditions of the probe gas as well as from the amounts of substances x_i and substance specific quantities such as calorific values per sort of molecule of the components and the respective masses of molecules, and taking into account of the selected default values for compressibility factor K and real gas factor Z_n the

needed input quantities for the determination of the compressibility factor K are determined. These ~~input quantities are used, to calculate the compressibility factor K by means of standard-arithmetic~~ procedures. In a further step of the procedure an iterative calculation in the way of an iterative recalculation of the input quantities is carried out with the determined value for the compressibility factor K as long, until the value of the compressibility factor K converges. There from the volumetric standard calorific value $H_{v,n}$ and the standard density ρ_n can be calculated. In the case of converging the needed quantities compressibility factor K, standard calorific value $H_{v,n}$ and the standard density ρ_n for determination of the quality of gas of a probe gas are known and can be used respectively for example for the calculation of the energy content of the transported gas. At each iteration the just determined value for the compressibility factor K is put back again into the equations for calculating the input quantities of the standard-arithmetic procedure and a new iteration step is carried out. By means of this procedure starting with the determination of the amounts of substances x_i out of the recorded spectrum and the iteration procedure with the help of the default values for the compressibility factor K and real gas factor Z_n after a respective number of iteration steps the really existing values for the compressibility factor K and there from than the values for standard-calorific value $H_{v,n}$ and the standard density ρ_n in the probe gas can be determined with adequate accuracy. In this way the compressibility factor K is determined out of the spectroscopical measurable quantities in operation conditions as well as out of the default values for the compressibility factor K and real gas factor Z_n and the real gas calculation itself can be carried out with standard-arithmetic procedures and these arithmetic procedures itself are again iterational procedures. --

On Page 14, for the second full paragraph, please substitute the following paragraphs:

--Also it may be thinkable, that the default values for compressibility factor K and real gas factor Z_n are taken from a characteristic diagram, that describes the influence of the pressure p_b at operating conditions and the temperature T_b at operating conditions for a known composition of a gas similar to the composition of the probe gas. As described before for the procedure according to claim [44] 87, in this way good starting values as a good first approximation for the compressibility factor K and the real gas factor Z_n can be determined, which contributes to a fast convergence also of this procedure according to the invention.

The invention concerns furthermore to a generic photometric device for the determination of a transmission spectrum of a probe gas, especially for carrying out one of the procedures according to claim 87 or claim 94.--

On Pages 21-22, replace the description of the Figures (page 21, line 7-page 22, line 2) with the following paragraphs:

--Figure 1 - a typical distribution in a spectrum for different ingredients of natural gas,

Figure 2a - fundamental procedure of a two-staged iterational procedure according to claim [44] 87,

Figure 2b - fundamental procedure of a two-staged iterational procedure according to claim [51] 94,

Figure 3 - a fundamental structure of a photometric device according to the state of the art,

Figure 4 - a device according to the invention related to claim 98 [55], which is coupled to a probe cell by means of waveguides and determines the spectrums by means of filters,

Figure 5 - a first device according to the invention related to claim 98 [66], in which a chopper arrangement with a sector element aperture is provided for selection of wavelengths,

Figure 6 - a second device according to the invention related to claim 98 [66], in which a chopper arrangement with a spiral aperture is provided for selection of wavelengths,

Figure 7 - a further device according to the invention related to claim 98 [66] according to the reference beam principal of claim 105 [72] ,

Figure 8 - an embodiment of the device according to figure 7 with synchronisation by the chopper arrangement itself,

Figure 9 - an embodiment of the probe cell as hollow shaft guide,

Figure 10 - a connection of the probe cell to a waveguide with the help of GRIND-lenses,

Figure 11 - an embodiment of the invention according to claims 104 to 106 [41 to 43] with a modulation of the measurement radiation.--

On Page 25, for the third full paragraph, please substitute the following paragraph:

--A multivariate analysis (MVA), as outlined in the literature (DVGW-worksheet 486), delivers the volumetric amounts of substances of the gas components at operation conditions. The here presented procedure according to claim [1] 87 describes, how moreover with these data the standard calorific value $H_{v,n}$, the standard density ρ_n and the compressibility factor K can be ascertained.--

On Pages 25-26, for the paragraph bridging pages 25-26, please substitute the following paragraph:

--With the procedure according to claim [8] 94 by means of a spectral weighting function the spectrums can be evaluated directly without detailed resolution of the individual gas components. The specification of the calorific value $H_{v,b}$ at operation conditions according to this procedure is lined out in the patent application DE 198 38 301.0. The volumetric amount of substance of CO_2 at operating conditions can be evaluated as separate absorption band according to common spectroscopic procedures.--

On Page 26, for the first full paragraph, please substitute the following paragraph:

--Vital component of the here introduced procedure according to claim [8] 94 is the spectral measurement of the density ρ_b at working conditions, therefore also the convolution of the spectrum with a spectral function is used. The physical background of the procedure is herein, that each binding of the infrared active gas components contribute for extinction and so represents the mass of the partners of the binding in the spectrum. The frequency of oscillation of the binding and therewith their spectral location depends on the reduced mass of the partners of the binding. Therewith the spectrum contains in its amount and its spectral distribution at appropriate evaluation information for the determination of the density of the gas.--

On Pages 26-27, for the paragraph bridging pages 26-27, please substitute the following paragraph:

--In the figures 2a and 2b the flows of the two-stage iterational procedure according to the above mentioned equations are illustrated once more precisely. In the figure 2a is represented the principal flow of the calculation of the procedure according to claim [1] 87 with the both alternative

iterational procedures AGA8-92DC and GERG88, which start from the results of the multivariate analysis (MVA) by means of the ascertained spectrum. In the figure 2b is represented however the principal flow of the calculation of the procedure according to claim 8, that starts from the results of the direct spectral evaluation (DAS) and than uses the iterational procedure GERG88.--

On Pages 28-29, for the paragraph bridging pages 28-29, please substitute the following paragraph:

--In the following figures 4 to 10 are outlined now advantageous embodiments of the device according to the invention [according to the claims 55 and 66]. Same numerals indicate respectively identical or functionally similar devices, so that in the figures 4 to 10. In essence only the differences in the respective embodiments are represented and otherwise is referred to the respective above mentioned description.--

On Page 30, for the first full paragraph, please substitute the following paragraph:

--In a first conceivable embodiment of the invention according to [claim 55 and] figure 4 the device is coupled by means of optical fibres 19 to the probe cell 3 and can like this be installed in an explosion-free room behind an explosion barrier 20, while the intrinsic measuring cell itself is located near the gas conduit 18 within not explosion free room. For the recording of a null spectrum and in doing so the offset-transmission of the optical system the probe cell 3 can be filled with a spectroscopical inactive inert gas 23, in infrared for example nitrogen. Alternatively the probe cell 3 can be admitted in addition with a calibrating gas 24 for the verification of the measurement values. Null- and calibrating measurement are carried out in appropriate selected time intervals and are controlled via a valve block 25 by the computational unit 10. This embodiment can also be combined with the other implementations.--

On Pages 30-31, for the paragraph bridging pages 30-31, please substitute the following paragraph:

--The [first embodiment of a] device presented in the figure 5 [according to the invention according to claim 66] works in combination with a prism- or grating-spectrometer, as well as provided in the embodiment according to the state of art according to figure 3. The selection of the wavelength is done thereby not by means of movements of a prism or of the grating or of the

radiation receiver 7, instead by a in a chopper arrangement 28 provided with a sector aperture 46. This sector aperture 46 owns free sectors 30, which sequential set free areas of the outlet slit of the grating 47 or the same and with it selected regions of wavelengths of the spectrum of the measurement radiation 8. A projection lens 22 maps the transmitted measurement radiation 8 to a radiation receiver 7; based on the slit-like geometry for the projection lens 22 for example a cylindrical lens will be the best opportunity. With the information of the position of the rotational direction 29 of the rotating aperture 46 and therewith of the wavelength the computational unit 10 determines a simplified transmission spectrum, which is evaluated with the above presented procedure. By the selection of the position and width of the sectors 30 regions of wavelengths can be selected, which are optimised for the above presented evaluation procedures, particularly for DSA. The computational unit 10 controls with signals 27 also the rotational movement of the aperture 46. An alternative type design of the chopper arrangement 28 according to claim 12 is represented in the figure 6. The chopper arrangement 28 acts appropriately to sector aperture 46 of the figure 5, whereby however not sequential fixed wavelength intervals are faded in, instead the spectrum rather gets scanned continuously by a spiral slit opening 31 arranged in the aperture 46. The advantage is thereby a superior flexibility for the evaluation of the spectrums, however the measurement time for every interval of wavelength is shortened and in doing so the signal-noise is increased. As with the chopper arrangement 28 according to figure 5 the computational unit 10 ascertains based on the position of the aperture 46 the respective present wavelength and in doing so records a transmission spectrum for the above evaluation procedures MVA and DSA.--

On Page 35, for the paragraph on this page, please substitute the following paragraph:

--The figures 4 to 11 show in a very simplified representation an equipment basic design of a device according to [the claims 55 or 66] claim 98. In this the description is restricted to the essential courses of the procedures and thereto necessary devices. It can be understood, that the expert can carry out with the teachings according to the invention according to the claims a large number of variations and adaptations, that also are covered by the item of the invention.--